

RAPID BIOASSESSMENT IN WADEABLE STREAMS & RIVERS BY VOLUNTEER MONITORS

PART 1: PROGRAM DESCRIPTION

Version 3

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State of Connecticut
Department of Energy & Environmental Protection
Bureau of Water Protection and Land Reuse
Planning and Standards Division
Ambient Monitoring Program
Daniel C. Esty, Commissioner

Rapid Bioassessment in Wadeable Streams & Rivers

by Volunteer Monitors

Part 1: Program Description

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PURPOSE: The purpose of this document is to describe the **Rapid Bioassessment in Wadeable Streams and Rivers by Volunteer Monitors (RBV)** program and describe water quality monitoring by the Connecticut Department of Energy & Environmental Protection (CTDEEP), Bureau of Water Protection and Land Reuse (WPLR). The RBV program was developed by WPLR to encourage and enable volunteer monitors to collect meaningful water quality information for their own use and use by WPLR for water quality assessments. The goal of RBV is to provide volunteer monitoring programs with a quick, efficient, and standardized methodology for the collection of macroinvertebrate community data from wadeable streams. This data can be used to screen for either very high or very low water quality and augment monitoring conducted by WPLR. WPLR has 20 sets of equipment available for short-term loan to groups who have sponsored at least 1-RBV training session and intend to submit samples to WPLR. Additional information including training can be obtained from **Meghan Ruta, Volunteer Monitoring Coordinator**, at phone (860) 424-3061 or email meghan.ruta@ct.gov

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INTRODUCTION:

Staff assigned to WPLR ambient water quality monitoring and assessment program are responsible for monitoring Connecticut's approximately 5,484 miles of perennial streams and rivers (CT DEP 1999). The monitoring program supports activities of the DEEP by providing data (chemical, physical, and biological) and related expertise to assess surface water quality conditions and trends. Monitoring occurs at both randomly selected sites and targeted sites. The targeted sites are prioritized by major watershed and focus on the most significant resources, selected reference sites, and in response to nuisance complaints or concerns regarding pollution impacts. Approximately 20% of state rivers and streams are monitored (CT DEP 2004) through the targeted approach and 100% of the 2-4 order Wadeable streams through the random approach.

Due to the large number of waterbodies, primarily 1 order, with little or no water quality information the potential for volunteer monitors to augment WPLR's monitoring efforts is quite large. Historically, data submitted by volunteers has covered a variety of parameters, generated through a variety of methods for a variety of reasons. Unfortunately, many times due to the lack of a standardized methodology, the type and nature of this data, and the limited resources available at the CT DEEP, detailed evaluation of this information has not regularly occurred.

In order to encourage, standardize and facilitate the generation of usable volunteer data, the monitoring program has developed *Rapid Bioassessment for Volunteers (RBV)*. RBV capitalizes on the utility of macroinvertebrate data while keeping the methods and equipment straightforward, standardized, inexpensive, and most importantly "rapid".

Groups who participate in RBV will be provided with a list of macroinvertebrates. Each organism on the list has distinct shape, structure, color, or behavior and provides key ecological information about the stream environment. Following the standard procedures, volunteers collect benthic macroinvertebrates in the fall and determine the relative abundance (none, few, some or many) of each macroinvertebrate on the list. The final product will be a completed data sheet and a representative voucher collection. The datasheet can then be submitted to Meghan Ruta via phone, fax, or email with the voucher collection submitted at a later date. The entire RBV process occurs at the stream site and can be completed by 2-3 monitors within 2 hours.

The most meaningful information for WPLR will come from those groups who are able to complete the RBV process at multiple sites (**during a single day in the fall**) along a reach of river not routinely monitored by WPLR. By evaluating the relative abundance of the benthic community at each site and establishing baseline information, subtle changes can be detected, provided the process is performed correctly.

RBV TRAINING: A daylong training/data collection workshop can be held for your organization free of charge*. The workshop is structured around instructional power-point presentations in the morning and data collection in the afternoon.

The data collection process is completed on site at a riffle (fast flowing rocky bottom). Participants wade into the water, dislodge the organisms into a net by scrubbing the rocks, sort and identify the different organisms present, and preserve a representative set of organisms for verification. At the completion of the session the data is submitted to the CT DEEP for incorporation into water quality assessments.

RBV workshops are scheduled on a first come first serve basis with priority for first time programs. Since the data collection occurs in the fall and there are a fixed number of weekend days, it is better to schedule well in advance. Every attempt will be made to accommodate each workshop request. The CT DEEP will provide all of the necessary equipment except for waders, hip boots or other waterproof foot ware.

TO BECOME INVOLVED*:

The prerequisites to sponsor a workshop are to:

- 1.) Assemble a group of a least 6 adults
- 2.) Reserve a meeting room centrally located to the potential monitoring stations. The room must have electricity and be capable of holding all of the participants.
- 3.) Contact Meghan Ruta to schedule a workshop date by phone (860) 424-3061 or email at meghan.ruta@ct.gov

*Individuals not associated with a monitoring program can be linked with a program in their local area.

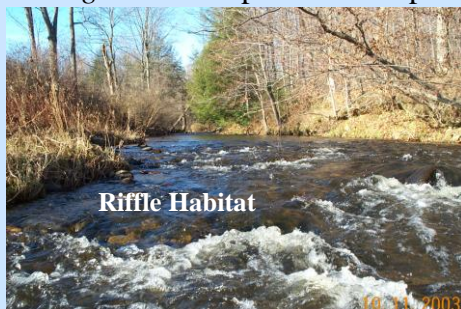
WHAT ARE RIFFLE-DWELLING BENTHIC MACROINVERTEBRATES?

Riffle-dwelling benthic macroinvertebrates are a community of organisms that live in freshwater river and streams. Insects dominate this community, however, crustaceans, worms, and mollusks can also be present. Each component of the phrase "riffle-dwelling benthic macroinvertebrate" has a specific definition and together they describe the characteristics of the community. In order to use this set of organisms to infer water quality, one must be aware of the definitions provided in the box below. The RBV protocol was developed specifically for this community. The RBV protocol is not appropriate for use in low-gradient streams and rivers, lakes, ponds, or wetlands or marine habitats.

"RIFFLE-DWELLING BENTHIC MACROINVERTEBRATE" DEFINED

RIFFLE-DWELLING: A *riffle* is an erosional section of a stream or river characterized by rapid turbulent flow, a stable rocky substrate, and is wadeable most of the year. Other major stream habitats are pools and runs/glides. These habitats differ from riffles in that they are usually slow moving, deep, have fine grained substrate like sand or gravel, and may not be wadeable most of the year. Different sampling and analysis methods are necessary to assess water quality in those streams dominated by pool or run/glide habitats.

Dwelling means to spend at least part of the life cycle living within the riffle habitat.



BENTHIC: Living in or on the substrate (bottom) of an aquatic environment.

MACRO: Large enough to be seen with the unaided eye. The US EPA further defines macro as capable of being retained in a standard number 30-mesh sieve.

INVERTEBRATE: An animal without a backbone.

Many macroinvertebrates can easily fit into a single ice cube tray compartment.






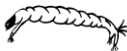





Sampling "benthic" organisms as part of the RBV protocol involves scrubbing and scraping the rocks found on the stream bottom in a riffle



WHY USE MACROINVERTEBRATES?

The macroinvertebrate community in a stream or river is very sensitive to stress and thus its characteristics serve as a useful tool for detecting environmental perturbation resulting from introduced point and non-point sources of pollution. Provided habitat and other environmental variables (including time of year) are controlled for the composition of the macroinvertebrate community is a function of water quality during the recent past, including any infrequently discharged pollutants that would be difficult to detect by periodic chemical sampling. Several advantages and disadvantages of using macroinvertebrates to assess water quality are listed in the table below. The most important advantages are they live a wide range of environmental conditions, they are easily collected, and there are established sampling and assessment methodologies readily available.

Advantages	Disadvantages
 <p>Macroinvertebrates communities are found across a continuum of water quality conditions from very high to very low.</p>	 <p>Lengthy time commitment to complete identifications due to the level of detail required to definitively identify species</p>
 <p>Macroinvertebrates show responses to a wide array of potential pollutants. Different types of environmental stress will often produce different macroinvertebrate communities</p>	 <p>Restricted to a riffle-habitat so this assessment method cannot be applied to low gradient rivers and streams.</p>
 <p>Methods for sample collection, processing, and data analyses are widely accepted, established, and documented.</p>	 <p>Collection dependant, poor collection conditions or technique can reduce the accuracy of assessment conclusions.</p>
 <p>Collectors can capture a representative sample of the macroinvertebrate community with relative ease, over a short period of time, and with simple, inexpensive equipment.</p>	
 <p>Knowledge of changes in the community structure and function of benthic macroinvertebrates helps to indicate water quality status and trends in the aquatic environment.</p>	
 <p>Macroinvertebrate populations can recover quickly from repeated sampling</p>	

MACROINVERTEBRATES vs. LEVEL OF EFFORT:

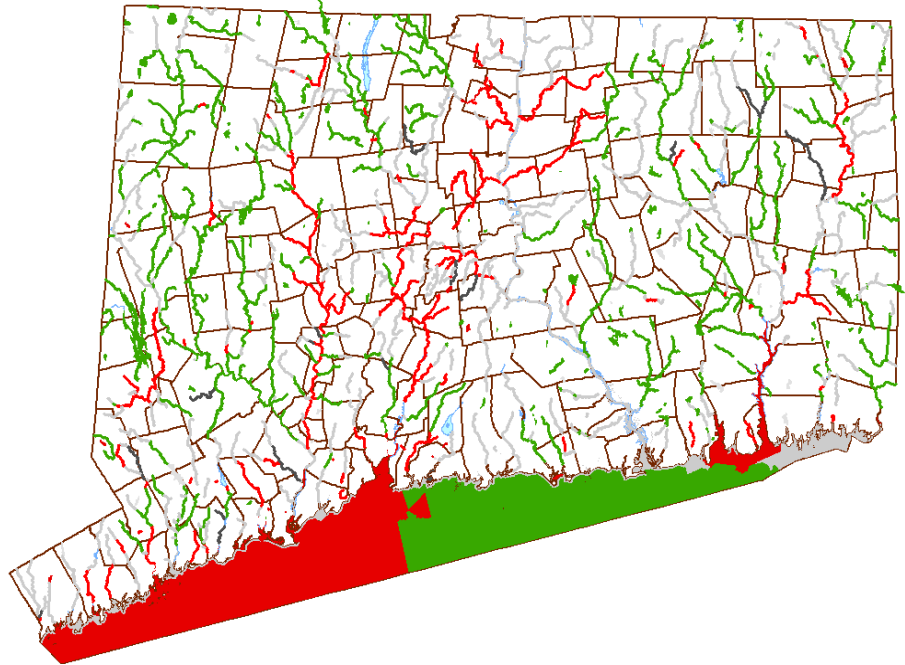
The basic framework for water quality assessments using macroinvertebrates rely upon collecting a representative sample of the macroinvertebrate community from a riffle habitat, processing the sample, identifying the organisms, and finally relating the organisms present in the sample to water quality. The major difference between assessment methods is the level of effort placed in processing and identifying the organisms. Processing methods vary from extremely thorough community structure assessments with species level identification to cursory in-the-field observation of rocks and leaf packs. The processing methods also differ by the way the community is sub-sampled, the level of identification, and the way the data are evaluated. Regardless of the method, if selected correctly, the outcome of the assessment will reflect current water quality conditions. When choosing a method appropriate for your program, you should weigh the time commitment and technical expertise required against the intended use of the data. A summary of 3 sample identification levels of effort is provided in the table below followed by additional text that describes each of the 3 levels of effort in greater detail.

Comparison of 3 different levels of sample identification effort when using riffle-dwelling benthic macroinvertebrates in bioassessments			
	Species Level ID (EPA RBP III)	Family Level ID (EPA RBP II)	Field Based ID (CTDEEP RBV)
Overall effort	Most difficult	Difficult	Not difficult
Collection effort	Kick net- 2 square meters of riffle area	Kick net-1 square meter of riffle area	Kick net-1 square meter of riffle area
Field processing effort	Remove large debris, preserve all net contents and bring to laboratory	Remove large debris, preserve all net contents and bring to laboratory	Remove large debris, sort organisms on site, preserve representative of each different type
Laboratory processing effort	Random sub-sample of 100,200,or 300 organisms	Random sub-sample of 100 organisms	No sub-sampling. The organisms are sorted immediately at the collection site.
Identification effort	Very rigorous specific keys and a microscope is required	Rigorous with family level key and a microscope is required	Simple with a basic flow chart and hand-lens. Based upon live organisms.
Data calculations (metrics)	Multi-metric index comparison to reference sample	Multi-metric index comparison to reference sample	Number of different types of pollution sensitive organisms present
Primary data use	Definitive water quality assessment (Bioassessment)	Somewhat definitive water quality assessment. It is very conservative and can falsely indicate impairment in non-impaired situations	Screening tool for very high or very low water quality, compare communities above and below potential sources
Expertise required	Very experienced	Some experience	Little experience
Time for citizen based program to complete 1 sample	Not practical or recommended, could take months	Days to a week	2 hours training 2 hours to complete the task (verification of organisms collected by trained entomologist)

SPECIES LEVEL IDENTIFICATION: Currently, WPLR's ambient monitoring program utilizes the aquatic invertebrate community as the primary indicator of biological integrity. The method is based upon the USEPA Rapid Bioassessment Protocol III (RBP III) for Streams and Rivers (Plafkin et. al 1989). RBP III involves collecting, sub-sampling, and identifying macroinvertebrates to species level and then calculating a series of community structure metrics. The score from each of the 7 metrics are averaged to generate a final community index score.

The primary use of RBP III assessments is to determine whether a section of stream supports or does not support the designated use goal for aquatic life. These assessments are also used for priority setting, trend monitoring, establishing baseline conditions, and evaluating wastewater discharges and NPS pollution.

2008 Connecticut Aquatic Life Use Support Assessment



Terms used to describe components of bioassessment protocols

SUB-SAMPLING: A process to generate a non-visually biased statistically representative sample of 100, 200 or 300 organisms collected in a sample. It involves bringing all of the material collected in the kick net back to the laboratory, evenly distributing the material in a tray with a grid on the bottom, randomly choosing grid number and then removing all organisms from that grid. The process of selecting grids continues until the target number of organisms has been exceeded.

COMMUNITY STRUCTURE METRICS: Are indexes and ratios calculated based on the variety and abundance of the different macroinvertebrates identified from the sub sample. The calculated values are used to mathematically compare two biological communities from different samples.

BIOASSESSMENT: An inference about water quality based upon the percent deviation of a macroinvertebrate community from a reference community. The deviation is determined by calculating the difference between samples for each of the community structure metrics. The larger the deviation from reference, the greater the difference in communities. Those communities significantly less than reference usually indicate impaired water quality.

REFERENCE SITE: a specific locality on a waterbody, which has been determined by biologists to be minimally impaired and is representative of the expected ecological integrity of other localities on the same waterbody or nearby waterbodies. Often reference sites are considered to be the "best attainable" condition for a particular region, watershed, or waterbody.

FAMILY LEVEL IDENTIFICATION:

Due to the utility of macroinvertebrate data, some volunteer monitoring groups have implemented programs similar to RBP III used by the DEEP. The primary difference is that the organisms, the community structure metrics are the reference site metrics are determined to the family level. The process is termed "Rapid Bioassessment", but even the most dedicated volunteers can struggle with the tedium of family level identification and can lose interest very quickly.

A family level identification key specific to the most commonly encountered Riffle-Dwelling Benthic Macroinvertebrates in Connecticut (<http://www.projectsearch.org/downloads/macrokey.pdf>) was developed by Mike Beauchene (former RBV Program Coordinator) in support of Project SEARCH. Project SEARCH is a high-school water quality-monitoring program designed to bring high-quality real-world application of science and technology to the classroom while concurrently generating usable water quality data. The identification key, accompanying reference materials, curriculum, and student activity pages are available on the Project SEARCH web page at: <http://www.projectsearch.org/>

RAPID BIOASSESSMENT IN WADEABLE STREAMS AND RIVERS BY VOLUNTEER MONITORS (RBV):

The RBV protocol includes 26 macroinvertebrates, each with distinct shape, structure, color, or behavior. The list was developed based on 3 criteria. Each organism on the list should have; a statewide distribution, provides key ecological information, and a unique behavior or morphological characteristic easily observed by first time participants. Detailed information about each organism can be found on the field identification cards/panels (http://www.ct.gov/dep/lib/dep/water/volunteer_monitoring/rbvcards.pdf). Each of these organisms has been placed into 1 of 3 categories *most wanted* (card/panels 1-8), *moderately wanted* (card/panels 9-14), and *least wanted* (card/panel 15). The most wanted category consists of macroinvertebrates found exclusively in streams characterized by excellent water quality. The moderately wanted category consists of those that can be found in streams with at minimum good water quality. The least wanted category consists of those that can be found in all levels of water from excellent to very poor. These 3 qualitative categories are intended to characterize water quality and are not intended to imply that a specific group is harmful or result in nuisance conditions.

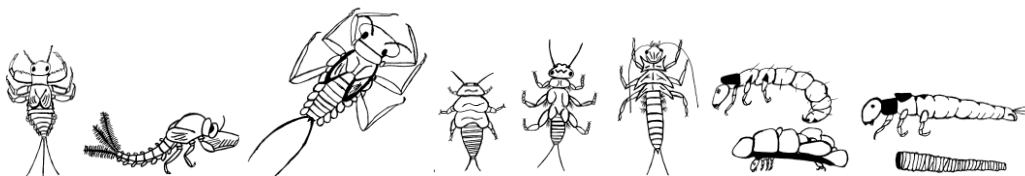
The RBV protocol **is not** a multi-metric approach as described earlier in this document nor is it a definitive assessment of water quality. **It is** a very useful screening tool for either very high or very low water quality. The RBV protocol was developed to encourage, standardize and facilitate the generation of usable volunteer data while keeping the method and equipment straightforward, standardized, inexpensive, and most importantly "rapid". The structure and design of the RBV protocol make it an excellent choice for citizen-based monitoring programs.

THE RBV ORGANISMS

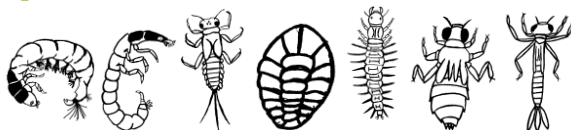
Additional information including Field Identification Cards can be found on the web at:
(www.ct.gov/dep/rbv)

Each RBV organism has distinct shape, structure, color, or behavior and provides key ecological information about the stream environment. Each of the organisms are grouped into one of three "wanted" categories; Most, Moderate, or Least. It is important to note that the "least wanted" are able to thrive in many environmental conditions while the "most wanted" thrive only under non-impacted high quality conditions. Therefore the most definitive RBV data are the collections with good representation of organisms in the "most wanted" category.

Most Wanted: In general these organisms require a narrow range of high quality environmental conditions. When found in abundance very good water quality can be inferred.



Moderately Wanted: These organisms can be found in a variety of environmental conditions from high to medium quality. When found in abundance and in the absence of most wanted types, water quality may be less than optimal.



Least Wanted: These organisms tend to be tolerant of a wide range of environmental conditions including poor water quality. When found in abundance and in the absence of either most or moderate representatives, some level of water quality impairment can be inferred.



Others: These are organisms that are commonly found across a variety of water quality conditions. These organisms tend to be either large, easily recognized, or in high abundance in RBV samples. They do not by themselves indicate water quality conditions. They have been added to the RBV datasheet beginning in 2005 based on participant requests. The presence of each type is indicated by a yes or no entry on the data sheet.



HOW THE DEEP AND OTHERS CAN USE RBV DATA

The DEEP volunteer monitoring coordinator, Meghan Ruta (860 424-3061), maintains a database (Microsoft Access) linked to a geographic information system (GIS). All voucher collections submitted to the DEEP monitoring program are verified, entered into the database, and vouchers stored in the ambient monitoring laboratory. At the conclusion of each sampling season, an annual summary report is published. This report can be accessed on the Internet at www.ct.gov/deep/rbv or by contacting Meghan Ruta directly.

The primary use of macroinvertebrate data by the DEEP is to compare the community structure to current water quality standards. This process is described in the Consolidated Assessment and Listing Methodology (CT CALM 2004). This comparison can provide an assessment of the degree of impairment and therefore the degree to which water quality standards are supported (CT 305(b) 2004).

HOW DOES RBV DATA FROM A SAMPLE MEASURE UP?

Reference Site Data: As part of the EPA RBP III protocol, the DEEP routinely samples a network of 10 reference sites. A reference site is a specific locality on a waterbody, which is minimally impaired and is representative of the best attainable water quality conditions. Reference sites also represent the expected ecological integrity of other localities on the same waterbody or nearby waterbodies. To evaluate the effectiveness of detecting high water quality conditions the RBV "wanted categories" were applied to reference site samples collected by CTDEEP (then CTDEP) during 1995-2000. The summary statistics for the reference site community data are presented in the table below. The minimum number of most wanted types collected at a reference station is 4; the mean is 7 and the maximum 9. Samples with 7 or more most wanted types, indicate the study site is minimally impaired and represents "best attainable" water quality conditions.

Statistic	Number of Most Wanted Types	Number of Moderately Wanted Types	Number of Least Wanted Types
Maximum	9	7	4
75 th percentile	8	6	3
Median	7	6	2
Mean	7	6	2
25 th percentile	5	5	1
Minimum	4	3	1

All Other Site Data: To calibrate the results of RBV samples with water quality assessments, the number of types in the "most wanted" category were summed for macroinvertebrate samples collected by WPLR staff between 1995 and 2002. Of the 256 samples 158 indicated good to excellent water quality, 85 fair water quality, and 13 poor water quality. The summary statistics for the number of "most wanted" types in each of these 3 categories are presented in the table below. At least 1 most wanted type was collected in all samples that were assessed to be fully supporting of aquatic life. The mean is 4 and the maximum 8. The mean and median values drop substantially between the fully supporting and partially supporting categories. Based on this analysis, samples with 4 or more most wanted types, indicate the study site is at most slightly impaired and is very close "best attainable" water quality conditions.

	Fully Supporting	Partially Supporting	Not Supporting
Sample Size	158	85	13
Maximum	8	4	1
75th percentile	5	1	0
Median	4	0	0
Mean	4	1	0
25th percentile	3	0	0
Minimum	1	0	0

RBV DATA USE:

Data collected according to the RBV protocol can be used as a screening tool to identify stream sections with either very high or very low water quality. The documentation (voucher collection) of key indicator organisms (the most wanted) in a section of a stream will provide a benthic record for the collection date and time. However, the absence of such indicators in any sample does not automatically mean the water quality is low, but rather further analysis may be required. In some situations current DEEP protocol may be necessary to definitively assess water quality. It is important to note that the "least wanted" are able to thrive in many environmental conditions while the "most wanted" thrive only under non-impacted high quality conditions. Therefore the most definitive RBV data are the collections with good representation of organisms in the "most wanted" category.

For those samples with 4 or more types in the "most wanted" category the WPLR monitoring staff are confident the location fully supports the state water quality standard for aquatic life (CT WQS 1997). Samples with 3 or less types in the "most wanted" category do not automatically indicate impairment or water quality degradation. In these situations additional review is conducted by DEEP to determine the particular species present, land use characteristics upstream of the monitoring location, and the potential for sampling/methodology errors.

RBV LIMITATIONS: The method is heavily dependent upon collecting an adequate sample from a riffle habitat, sorting the organisms to find all of the different types present, and most importantly placing one of each different type of organism into a vial with alcohol and a label. Datasheet entry is verified against the organism present in the vial. If the organism is not in the vial but recorded on the datasheet, it is not counted in the sample. It is critical that at least one of each different type of organism present in the sample is placed in the vial.

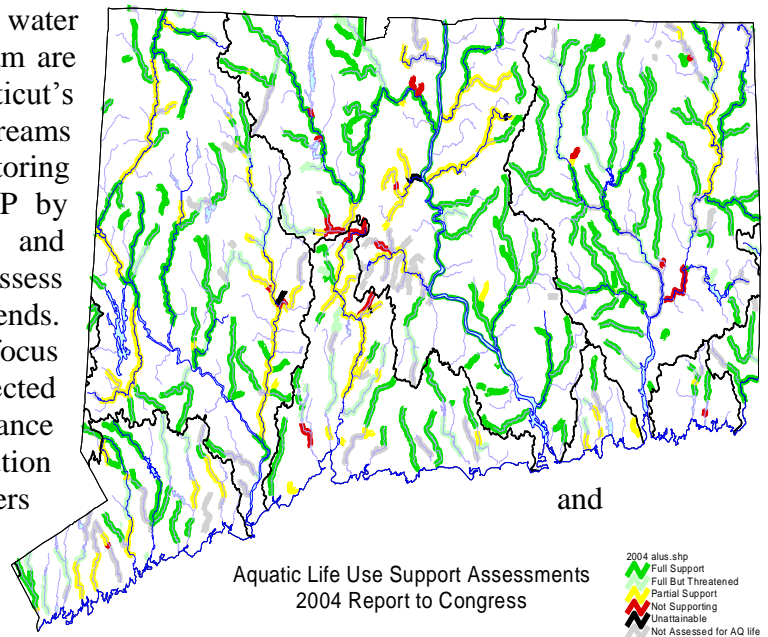
Some common mistakes that can reduce the quality of the data include:

- **Sampling during high flows or inclement weather**
- **Collecting from sub-optimal areas within the riffle habitat such as very large substrate, sand, or fine gravel.**
- **Focusing on removing large numbers of a few dominant types and not removing as many different types as possible**
- **Not placing a representative of each type in the voucher collection**
- **Not using adequate preservative resulting in deteriorated specimens**
- **Not removing enough of the large debris such as leaves, gravel, sticks so that the organisms can be found**

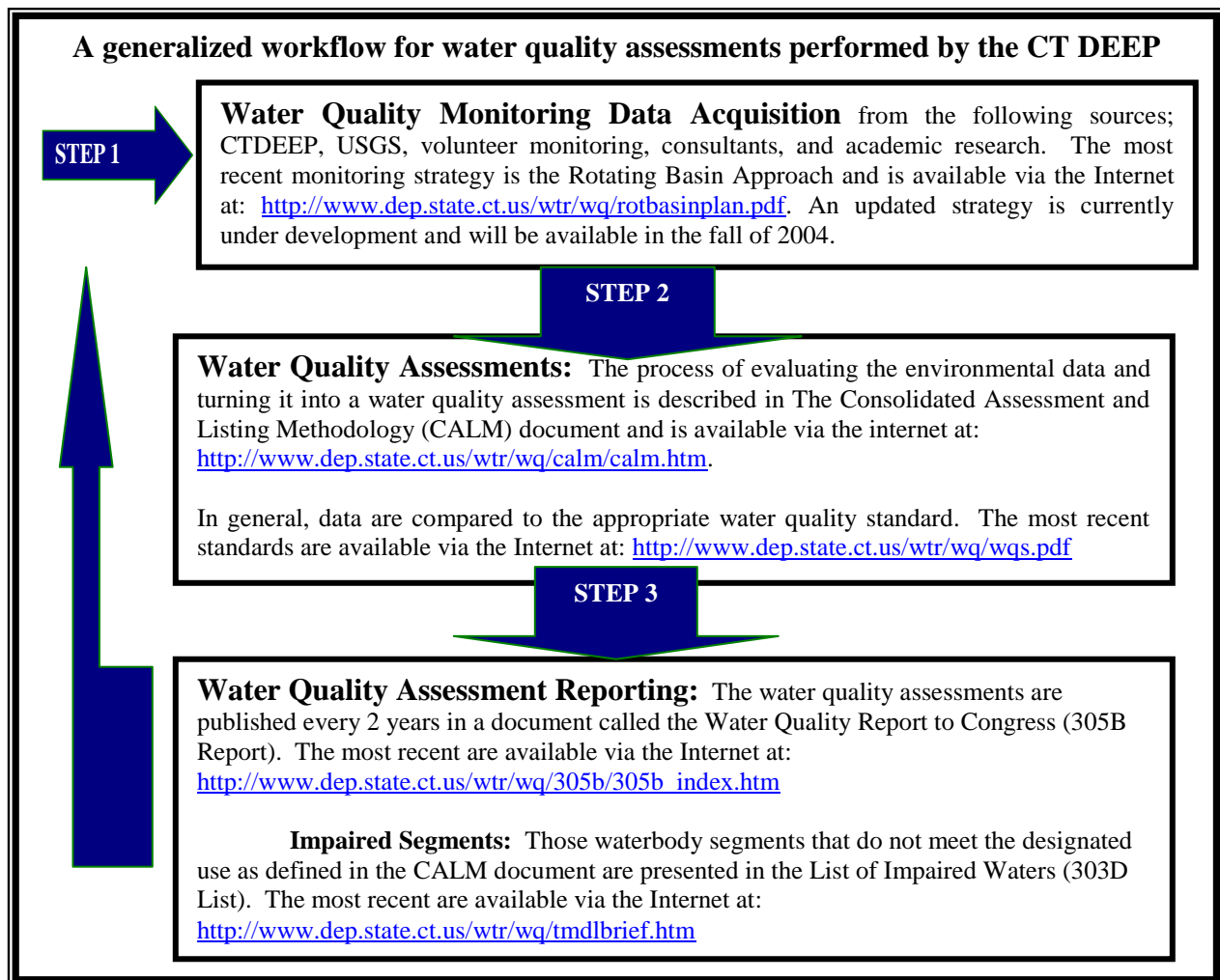
RIVER AND STREAM ASSESSMENTS BY THE CT DEEP:

Staff assigned to the ambient water quality monitoring and assessment program are responsible for monitoring Connecticut's approximately 5,484 miles of perennial streams and rivers (CT DEP 1999). The monitoring program supports activities of the DEEP by providing data (chemical, physical, and biological) and related expertise to assess surface water quality conditions and trends. Monitoring activities are prioritized and focus on the most significant resources, selected reference sites, and in response to nuisance complaints or concerns regarding pollution impacts. Approximately 20% of state rivers streams are monitored (CT DEP 2004).

The ultimate use of water quality data is to provide an assessment of the level of support for each designated use for each river segment. This assessment process is documented and described in the CT-Consolidated Assessment and Listing Methodology (CT DEP 2004 CALM). A simple workflow diagram of the major steps in the CALM process is presented below. During step 1 data are collected and evaluated, in



step 2 the data are compared to water quality standards and each river segment is assigned a level of support for each designated use, finally in step 3 the water quality assessments are reported to the public via the Report to Congress 305(b) [CT DEP 2004 305(b)] and the List of Connecticut Waterbodies not Meeting Water Quality Standards 303(d) [CT DEP 2004 303(d)]. The cycle is ongoing and repeats itself with the monitoring and assessment cycle.



DEEP-WPLR's SUPPORT FOR VOLUNTEER MONITORING:

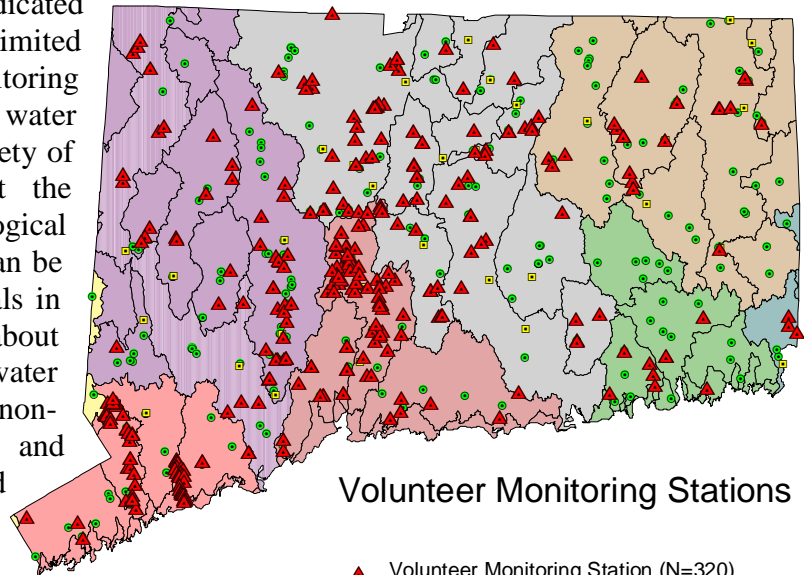
In June 1998, a staff position was added to DEEP's monitoring program to assist in evaluating and assessing water quality data and to provide greater technical assistance to volunteer monitoring organizations to improve data quality. This position has fostered the development of a monitoring database linked to a geographic information system

(GIS) and increased evaluation of volunteer data. In an attempt to insure maximum and efficient use of volunteer data, the DEEP recommends that groups intending to submit data to the DEEP work closely with DEEP's volunteer monitoring coordinator (Meghan Ruta 860-424-3061).

VOLUNTEER MONITORING-HISTORICAL

Volunteer monitoring continues to attract interested citizens in Connecticut as well as nationwide. To date volunteer monitors have collected surface water quality data from over 400 sites across the state. The major benefits of a volunteer monitoring program can be to assist state and local resource managers, increase resource stewardship and environmental awareness, educate the general public, and most importantly assemble information specific to the objectives of the monitoring group.

While each volunteer monitoring organization is unique, the majority can be described as small groups of dedicated participants funded through a very limited budget (if at all). Their monitoring activities typically focus on water quality, intending to educate a variety of audiences and themselves about the physical, chemical, and biological condition of a waterbody. Data can be submitted to state and local officials in order to provide information about baseline conditions, screen for water quality issues, assess potential non-point source (NPS) pollution, and provide information for watershed planning.



There are many different water quality related resources available to volunteer monitoring organizations including manuals, web sites, equipment, and analysis techniques. Most are excellent and can be useful to meet specific goals and objectives. Unfortunately, water quality data generated through some of these methods may not be applicable for use by the DEEP.

THE TIERED APPROACH:

Meaningful volunteer data can be collected at several different technical levels of effort. It is critical that a start-up monitoring program does not take on more than it can handle. When determining what, where, and when to monitor, a volunteer group should evaluate funding required, resources available, effort required, and the number of dedicated volunteers. The DEEP recommends a tiered approach, beginning with observational monitoring. As a group acquires resources, volunteers, and information, the monitoring activities generally become more complex and shift focus. Regardless of

the specific monitoring activity or tier level, each group will contribute meaningful information to the DEEP provided protocols are followed. The tiered approach is described in detail and is available on the Internet at: http://www.ct.gov/dep/lib/dep/water/volunteer_monitoring/tierapp.pdf or by contacting Meghan Ruta (860) 424-3061 or email Meghan.ruta@ct.gov

Tier 1: Observational Monitoring

A.) Periodic Visual Observation

Some of the most valuable monitoring data volunteers can submit involves periodic visual observation of stream and near stream conditions. Citizen monitors can readily observe and document stream condition at multiple locations during optimal time frames (for example during or following storm events). This type of information is extremely difficult for DEEP to obtain on a statewide basis.

Detailed observational data can augment the DEEP's periodic physical, chemical, and biological data by providing day-to-day or week-to-week stream conditions. Even more importantly, citizens can potentially expedite water quality improvement by immediately notifying local officials or appropriate DEEP staff of abnormal conditions at pump stations, catch basins, or storm water outfalls that can initiate timely follow-up inspection by regulatory personnel.

B.) Stream walks

A stream walk is a one-time comprehensive visual assessment of a continuous section of a stream or streams within a watershed. The goal is to provide information about the stream channel and surrounding land use. In addition, volunteers document "areas of concern", which may impair water quality or warrant further investigation. The major benefits of stream walks are the information from continuous sections of stream and the resource stewardship it fosters among participants. Stream walks may be structured to provide participants with opportunities to learn about the links between land use and stream water quality, the process of resource management, and encourage partnership with local planners and regulatory agencies.

DEEP encourages groups interested in organizing a stream walk follow the protocols developed by the USDA Natural Resources Conservation Service. The materials for the stream walk have been standardized and can be found at: http://www.ct.nrcs.usda.gov/streamwalk_initiative.html

Tier 2: Rapid Bioassessment in Wadeable Streams and Rivers by Volunteer Monitors (RBV)

This program has been described previously in this document.

Tier 3: SPECIFIC MONITORING PROJECT INCLUDING A DETAILED QUALITY ASSURANCE / QUALITY CONTROL (QA/QC) PLAN

Traditional monitoring parameters (temperature, pH, dissolved oxygen, nutrients, indicator bacteria, and family level macroinvertebrate identification) can be used by DEEP on an individualized basis. However, due to the limitations of grab sample chemistry, timing of sample collection, equipment required, and rigors of quality assurance and quality control, this type of monitoring is not initially recommended. Volunteer monitors and DEEP staff must invest substantial time and effort to develop an appropriate monitoring plan for a group interested in pursuing this type of program.

Information from tier 3 will result from a detailed monitoring plan specifically designed to provide scientific information pertaining to a distinct water quality issue. To insure usable high quality data, each plan should be co-developed by the monitoring group and the DEEP.

Some successful Tier 3 programs include:

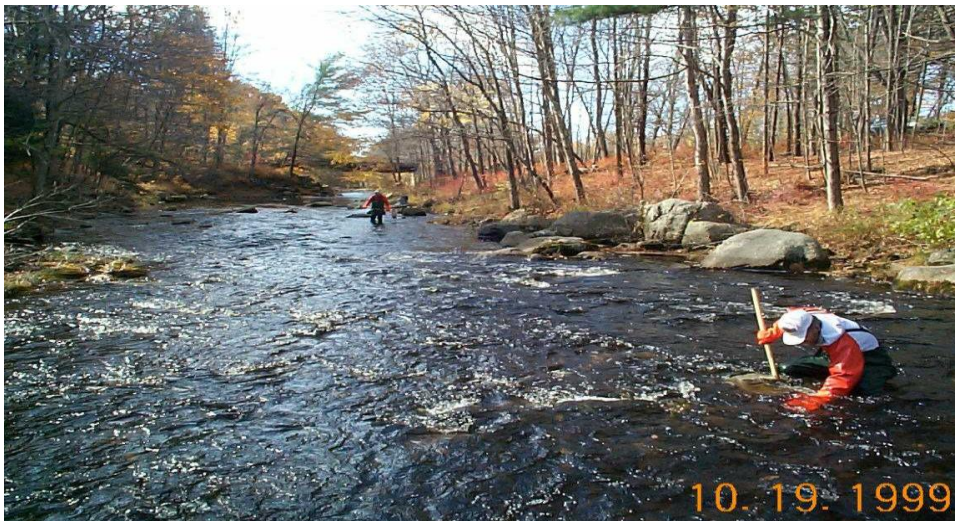
Connecticut River Watch has successfully collected usable indicator bacteria and water chemistry data from the Mattabesset River and its many tributaries. Details can be found on their web page at:

<http://www.conservect.org/ctrivercoastal/riverwatch/>

Earthplace, has successfully collected usable indicator bacteria data from Sasco Brook, Norwalk River, and the Saugatuck Regional Basin. Details can be found on their web page at:

http://www.earthplace.org/environment/water_quality.html

Project SEARCH, a school-based water quality monitoring program. Details can be found on their web page at: <http://www.sciencecenterct.org/projectsearch/>



Additional Resources for volunteer monitors:

Volunteer Stream Monitoring: A Methods Manual. 1997. US EPA Office of Water. US EPA publisher, Washington D.C., Publication number EPA 841-B-97-003.

<http://www.epa.gov/owow/monitoring/volunteer/stream/>

Streamkeepers: Aquatic Insects as Biomonitor. 1997. Xerces Society, Mary Troychak ed. The Xerces Society, Portland. Phone (508) 232-6639.

Aquatic Entomology. 1981. W. Patrick McCafferty. Jones and Bartlett publisher, Boston. ISBN number 0867200170.

Rapid Bioassessment Protocols for Use in Streams and Wadeable Rivers: Periphyton, Benthic Macroinvertebrates and Fish, **Second Edition**. Barbour, M.T., J. Gerritsen, B.D. Snyder, and J.B. Stribling. 1999. EPA 841-B-99-002. U.S. Environmental Protection Agency; Office of Water; Washington, D.C. <http://www.epa.gov/owow/monitoring/rbp/>

Rapid Bioassessment for Protocol for Use in Streams and Rivers: Benthic Macroinvertebrates and Fish. 1989. James L. Plafkin, Michael T. Barbour, Kimberly D. Porter, Sharon K. Gross, and Robert M. Hughes. US EPA publisher, Washington D.C., Publication number EPA/440/4-89/001.

An Introduction to the Aquatic Insects of North America. 3rd ed. 1996. Richard W. Merritt and Kenneth W. Cummins eds. Kendall Hunt Publisher, Dubuque. ISBN number 0840375883

A Guide to Common Freshwater Invertebrates of North America. Voshell, J.R. 2002. McDonald & Woodward Pub Co., Blacksburg, VA.

Electronic Resources:

www.epa.gov/owow/monitoring/vol.html

this site provides electronic versions of many of EPA's volunteer methods manuals and brochures, as well as The Volunteer Monitor Newsletter, the national newsletter of the volunteer monitoring community.

<http://water.nr.state.ky.us/ww/vm.htm>

Are volunteer monitoring groups on line? Do they need to be? The answer is yes to both questions. Electronic mail and the World Wide Web are proving to be popular tools for a number of groups. If an organization has a question about water quality, a recent query of the term "Water Quality" on an on-line search service yielded more than 30,000 web pages that dealt with the topic. For Volunteer Monitoring in particular there were more than 2000 pages listed. A search of EPA's site alone yielded 340 documents that referenced "Volunteer Monitoring".

So you don't have the time to sort through all those pages for something useful? We have done that for you. The list below is an *incomplete* summary of high-quality web sites that deal directly with the field of volunteer monitoring. If your site isn't on here, [let us know](#), we will add it!

<http://www.iwla.org/siteindx.htm>

This is the website for one of the oldest and largest volunteer monitoring programs in the country. Variants of the Save Our Streams methods are in use in many states.

www.riverwatch.org

We offer workshops, organizational and technical support and consultation, publications, and other tools that help groups and individuals monitor and protect rivers.

So rather than send do-it-yourself kits with instructions for water sampling, we guide people through an 11-step process developed during the course of our work with thousands of volunteers since 1987. We teach scientifically credible methods for collecting and analyzing water samples and documenting findings. Then we recommend actions for river protection and improvement, and develop plans for making sure that those recommendations are acted on by regulatory agencies and government authorities.

www.ag.ohio-state.edu/~waternet

This site provides information about how to get involved in volunteer monitoring, not only in Ohio but through other Cooperative Extension programs.

www.edc.uri.edu/rreapage/h2owatch

The University of Rhode Island Watershed Watch Program (URIWW) is a statewide volunteer monitoring program. It focuses on providing current information on the water quality of surface water resources throughout Rhode Island, including lakes, ponds, reservoirs, rivers, streams and the marine environment.

The heart of the program consists of weekly measurements taken by numerous trained volunteer monitors. The program emphasizes watershed scale monitoring because the water quality of a given body of water is a reflection of the activities in the lands and waters that surround it and lie upstream.

The program is intended to encourage communities and shoreline residents to understand the need to cooperatively manage and improve the water quality of all the water bodies within a watershed. In this way we can ensure that Rhode Island's bays, estuaries, and freshwater resources remain one of the state's great assets.

<http://www.epa.gov/surf/>

Surf Your Watershed is a service to help you locate, use, and share environmental information on your watershed or community. A driving force behind Surf Your Watershed is to get environmental information into the hands of active citizens and groups and to help those people connect and share information, ideas, and assistance. EPA supports the public's right-to-know and hopes that Surf Your Watershed will contribute to the public's understanding of environmental issues.

<http://www.epa.gov/OWOW/monitoring/>

This homepage contains a wide variety of resources for anyone interested in learning more about water quality monitoring, automated data management, and geographic information systems. We have provided many actual USEPA guidance documents, fact sheets, and final reports, and will be adding new documents as they become available. You may order many of these articles by visiting the [Information Resources and Services](#) homepage under the Office of Wetlands, Oceans, and Watersheds.

<http://www.epa.gov/owow/monitoring/volunteer/stream/>

The purpose of this manual is not to mandate new methods or override methods currently being used by volunteer monitoring groups. Instead, it is intended to serve as a tool for program managers who want to launch a new stream monitoring program or enhance an existing program. *Volunteer Stream Monitoring* presents methods that have been adapted from those used successfully by existing volunteer programs.

Further, it would be impossible to provide monitoring methods that are uniformly applicable to all stream watersheds or all volunteer programs throughout the Nation. Factors such as geographic region, program goals and objectives, and program resources will all influence the specific methods used by each group. This manual therefore urges volunteer program coordinators to work hand-in-hand with state and local water quality professionals or other potential data users in developing and implementing a volunteer monitoring program. Through this partnership, volunteer programs gain improved credibility and access to professional expertise and data; agencies gain credible data that can be used in water quality planning. Bridges between citizens and water resource managers are also the foundation for an active, educated, articulate, and effective constituency of environmental stewards. This foundation is an essential component in the management and preservation of our water resources.

<http://www.epa.gov/OWOW/monitoring/volunteer/qappcovr.htm>

The quality assurance project plan, or QAPP, is a document that outlines the procedures that those who conduct a monitoring project will take to ensure that the data they collect and analyze meets project requirements. It is an invaluable planning and operating tool that outlines the project's methods of data collection, storage and analysis. It serves not only to convince skeptical data users about the quality of the project's findings, but also to record methods, goals and project implementation steps *for current and future volunteers* and for those who may wish to use the project's data over time.

Developing a QAPP is a dynamic, interactive process that should ideally involve quality assurance experts, potential data users, and members of the volunteer monitoring project team. It is not an easy process. This document is designed to encourage and facilitate the development of volunteer QAPPs by clearly presenting explanations and examples. Readers are urged to consult, as well, the additional resources listed in the appendices to this document, and to contact their state or U.S. Environmental Protection Agency (EPA) Regional quality assurance staff for specific information or guidance on their projects.

http://www.epa.gov/OWOW/monitoring/volunteer/vm_index.html

The Volunteer Monitor newsletter facilitates the exchange of ideas, monitoring methods, and practical advice among volunteer environmental monitoring groups across the nation.

<http://www.epa.gov/owow/monitoring/rbp/> As the technical guidance for biocriteria has been developed by EPA, states have found these protocols useful as a framework for their monitoring programs. This document was meant to have a self-corrective process as the science advances; the implementation by state water resource agencies has contributed to refinement of the original RBPs for regional specificity. This revision reflects the advancement in bioassessment methods since 1989 and provides an updated compilation of the most cost-effective and scientifically valid approaches.